Project B-209

FLAT GLASS

A Manufacturing Opportunity in Georgia

Prepared for

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June 1963

Table of Contents

Foreword

This report is one of three dealing with different types of glass for which profitable manufacturing opportunities exist in Georgia. The second, on kitchen and table glassware, is being released almost simultaneously. The third, on scientific glass, will be ready for publication shortly.

In this particular instance, the changing market picture now makes it practicable for one of the large glass manufacturers to consider locating a plant in Georgia to serve the large and growing southeastern market. The necessary combination of location requirements essential to a profitable operation is to be found in Georgia, as noted in detail in the report.

Questions regarding specific location possibilities, requests for further information which might be desired by a particular company, and comments on the study are invited.

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Summary

The market for flat glass in the Southeast[1/] totaled approximately 214 million square feet in 1960. This market consisted of almost 199 million square feet of sheet and plate glass and about 15 million square feet of automotive glass. This combined market can be expected to reach 274 million square feet by 1968.

Flat glass is produced in three plants in the Southeast, all of which are located in Tennessee. One plant, located in Nashville, is owned by the Ford Motor Company. The other two plants, at Kingsport and at Greenland, are owned by American St. Gobain Corporation.

Although the above plants are quite large, with a combined capacity in excess of 300 million square feet annually, only a limited amount of their production is shipped to southeastern cities. As a result, much of the flat glass used in the area comes from distant points in Illinois, Ohio and West Virginia at high freight costs.

Therefore, a manufacturer of flat glass locating in Georgia would enjoy freight advantages over plants now serving the Southeast. Rail freight costs from Columbus, Georgia, to leading southeastern markets would average (depending upon type of glass) from $3.90 to $13.21 per ton less than from the nearest existing plants. If the glass is shipped by truck from these same points of origin, a freight saving of from $3.73 to $20.78 per ton may be realized.

Sheet glass affords the most favorable glass manufacturing opportunity for Georgia because:

1. it enjoys a high volume market,
2. present suppliers are all located outside the Southeast,
3. recent improvements in technology make sheet more competitive with plate, particularly in automotive glass,
4. a Georgia producer with $5 million in sales in the Southeast can realize an annual freight savings of $150,000 to $500,000 over the two closest existing sources of supply, and

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[1/] Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee

5. the raw materials necessary in the manufacture of flat glass are generally available in the immediate area, with the exception of soda ash which comes from the Gulf Coast.

INTRODUCTION

The flat glass industry is dominated by a few large firms with plants concentrated mostly in the Midwest and Middle Atlantic sections of the country. In 1958 shipments valued at $375 million, or 97% of the industry total, were produced by 23 plants.

Today most of the flat glass used in the Southeast comes at high freight costs from plants located in Illinois, Ohio, Pennsylvania and West Virginia. However, the growth of regional markets for glass and competition from the increased volume of imports have contributed toward the feasibility of highly efficient regionally oriented plants where markets exist. The objective of this report is to determine to what extent conditions favor the manufacture of flat glass in Georgia.

The report contains separate estimates for three main segments of the flat glass industry, as follows:

1. sheet (window) glass,
2. plate glass, and
3. automotive glass.

Although automotive glass is treated as an individual category in this report, it is made from either sheet or plate glass and may be produced in conjunction with the other two types of flat glass.

Columbus, Georgia, is used as an illustrative site because of its proximity to both raw materials and existing markets. In addition, water transportation will be available to enhance its position as a desirable location for a flat glass plant.

THE SOUTHEASTERN FLAT GLASS MARKET

Current Market

Although sheet and plate glass are used primarily in building construction, they are also used extensively in the transportation and furniture industries.

An extremely high correlation (0.952) has been established between residential and nonresidential construction and flat glass production during the past decade. (See Appendices 1 and 2.) This correlation helps in approximating the volume of flat glass used in building construction in the Southeast.

In 1960, the value of construction contracts awarded for the Southeast totaled $1.98 billion, or 11% of the total for the United States.[1/] When this percentage is applied to the U. S. data for sheet and plate glass production,[2/] the following estimates result:

	U. S. volume	x Southeast percentage	= Southeast volume
Sheet Glass	1,012 million square feet	x 11%	= 111.3 million square feet
Plate Glass	662 million square feet	x 11%	= 72.8 million square feet
			Total = 184.1 million square feet

In 1960 imports of flat glass minus exports of flat glass were slightly over 8% of domestic production. By assuming a southeastern import percentage similar to that of the United States, a consumption volume of 198.8 million square feet may be estimated for the Southeast.

Since laminated glass is not part of the above figures, automotive glass is not included in these estimates. A different method was used for approximating this segment of the glass market. Under this method original equipment and replacement glass were considered separately.

1/ Construction Review, Bureau of the Census, U. S. Department of Commerce, April 1961.

2/ Flat Glass Industry, Outlook for 1962 and Review of 1961, Business and Defense Services Administration, U. S. Department of Commerce, ER 60-80, January 4, 1962.

The original market was estimated on the basis of a motor vehicle output of 200,000 units multiplied by an average of 45 square feet of glass per unit, which totals nine million square feet. This figure excludes one company which produces its own glass.

The market for auto replacement glass was determined by applying glass breakage rates to data reflecting the number of motor vehicles in use in the Southeast.[1/] Glass breakage rates were provided from loss experience records of a leading Atlanta insurance firm. There were four cases of windshield breakage per 100 cars and six cases of side glass breakage. Windshields average 10 square feet and side glass about three square feet.

Southeast vehicles x breakage rates x square feet per car = square feet of windshield replacement

Windshield Glass	9.1 million x 4% x 10 square feet = 3.640 million square feet
Side Glass	1.1 million x 6% x 3 square feet = 1.638 million square feet

After adding about 300 thousand square feet for back glass breakage (about 10 windshields are broken to one back glass), the replacement market totals almost six million square feet. The total automotive glass market in the Southeast, therefore, was approximately 15 million square feet in 1960.

Forecast for the Flat Glass Market

The market for flat glass in the Southeast should reach 274 million square feet by 1968. This market will be comprised of about 145 million square feet of sheet glass and 114 million square feet of plate glass. The remaining 15 million square feet will be largely automotive glass.

The above estimates for sheet and plate glass are based upon projections of national growth trends established during the period from 1950 to 1960. (See Figures 1 and 2.) A continuation of these trends would result in a 21% increase in national sheet glass production and a 45% increase in national plate glass production between 1960 and 1968. The projection is compatible

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[1/] Automobile Facts, 1961: American Automobile Manufacturers Association.

FIGURE 1

TREND OF SHEET GLASS PRODUCTION IN THE U.S.

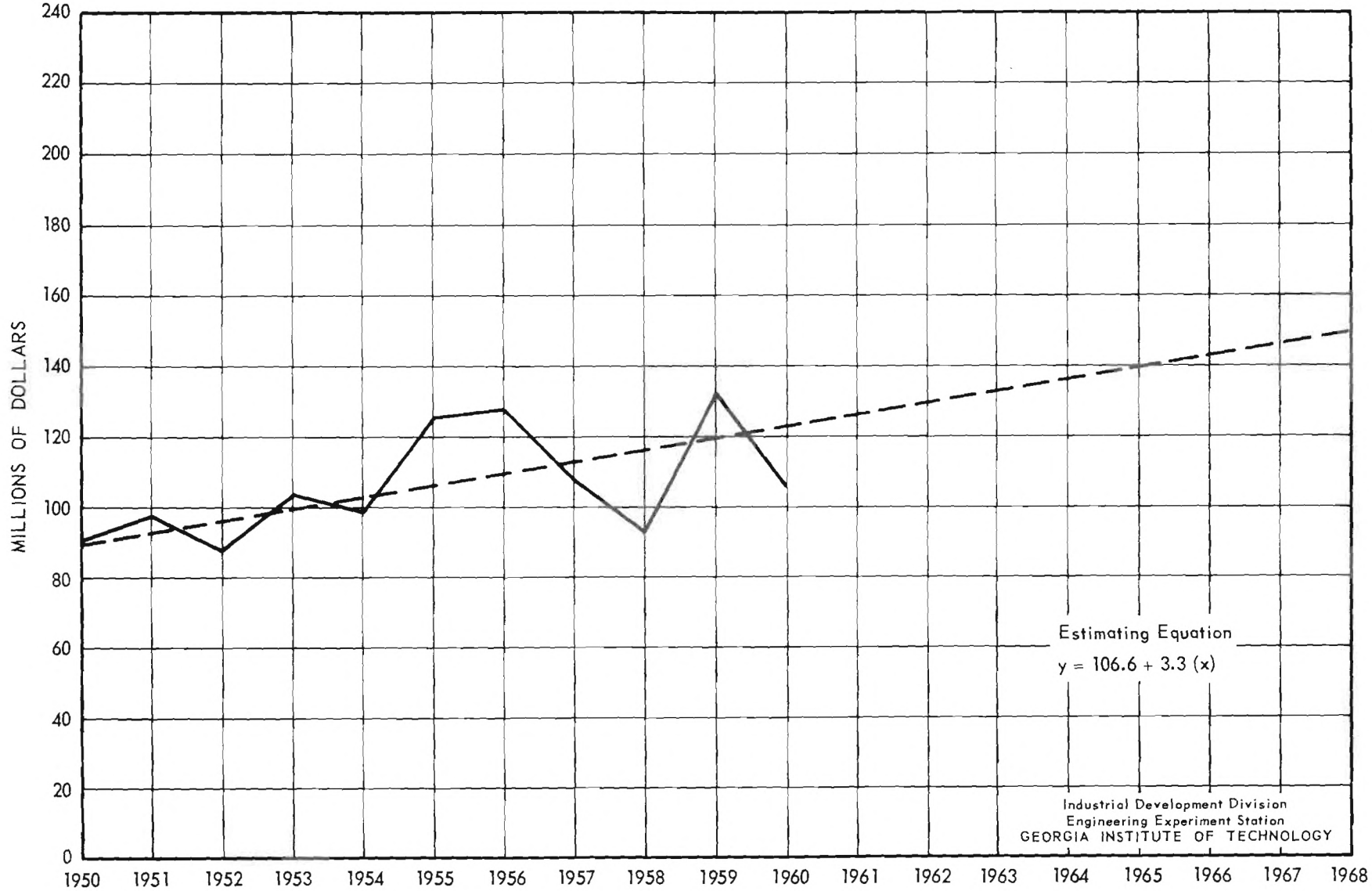
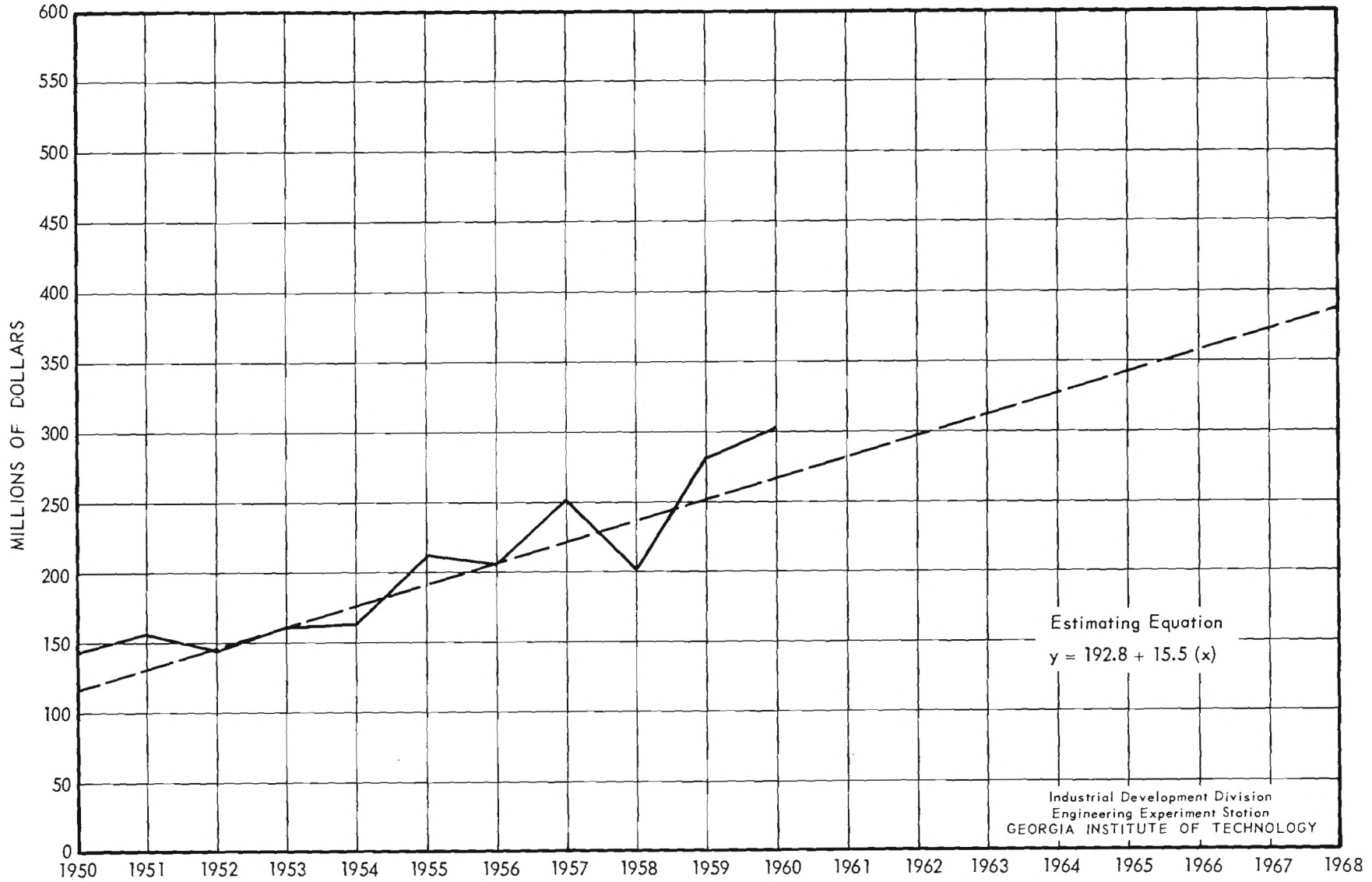


FIGURE 2

TREND OF PLATE GLASS PRODUCTION IN THE U.S.



with the projected growth in building construction[1/] (see Figure 3) and appears to present a realistic forecast for the period to 1968.

Time series data for flat glass are not available for the Southeast. However, the extremely high correlation between residential and nonresidential building construction and flat glass production can be used to estimate the future southeastern market for flat glass. Over 11% of the national residential and nonresidential building total is constructed in the southeastern states. By applying this same percentage to the national glass production projections a valid market may be forecasted for the Southeast.

A different approach was taken in forecasting the demand for automotive glass. The forecast was based on the following factors:

1. The percentage of glass in new motor vehicles is not expected to change appreciably in the period to 1968.
2. Due to the increased acceptance of the compact car, the average area of glass per unit is expected to drop by about 20% in the future.[2/]
3. The universal acceptance of tempered glass in all areas of the vehicle except the windshield is expected to considerably reduce breakage rates.
4. The number of vehicles on the road in the Southeast is expected to increase by 31% between 1960 and 1968. (See Figure 4.)

Factor 4 should counterbalance factors 2 and 3. The best forecast would likely place market volume of automotive glass in 1968 at about the 1960 level, or about 15 million square feet.

Perhaps of more significance to the future of automotive glass than growth rates is the trend toward tempered sheet in all areas except the windshield. The development of tempered sheet and the superior surfaces afforded by the vertically drawn process now place a sheet manufacturer in a favorable position to enter markets previously dominated by plate glass. In addition, the "float process," an advancement in the production of glass, soon will be used in the U. S. by the two largest American glass producers.

1/ "Building in the Sixties," Architectural Forum, February 1960.

2/ Bleeker, Henry, "Auto Glass Distribution -- the Future," Glass Digest June 1961.

FIGURE 3

TREND OF RESIDENTIAL AND NONRESIDENTIAL BUILDING CONSTRUCTION IN THE U.S.

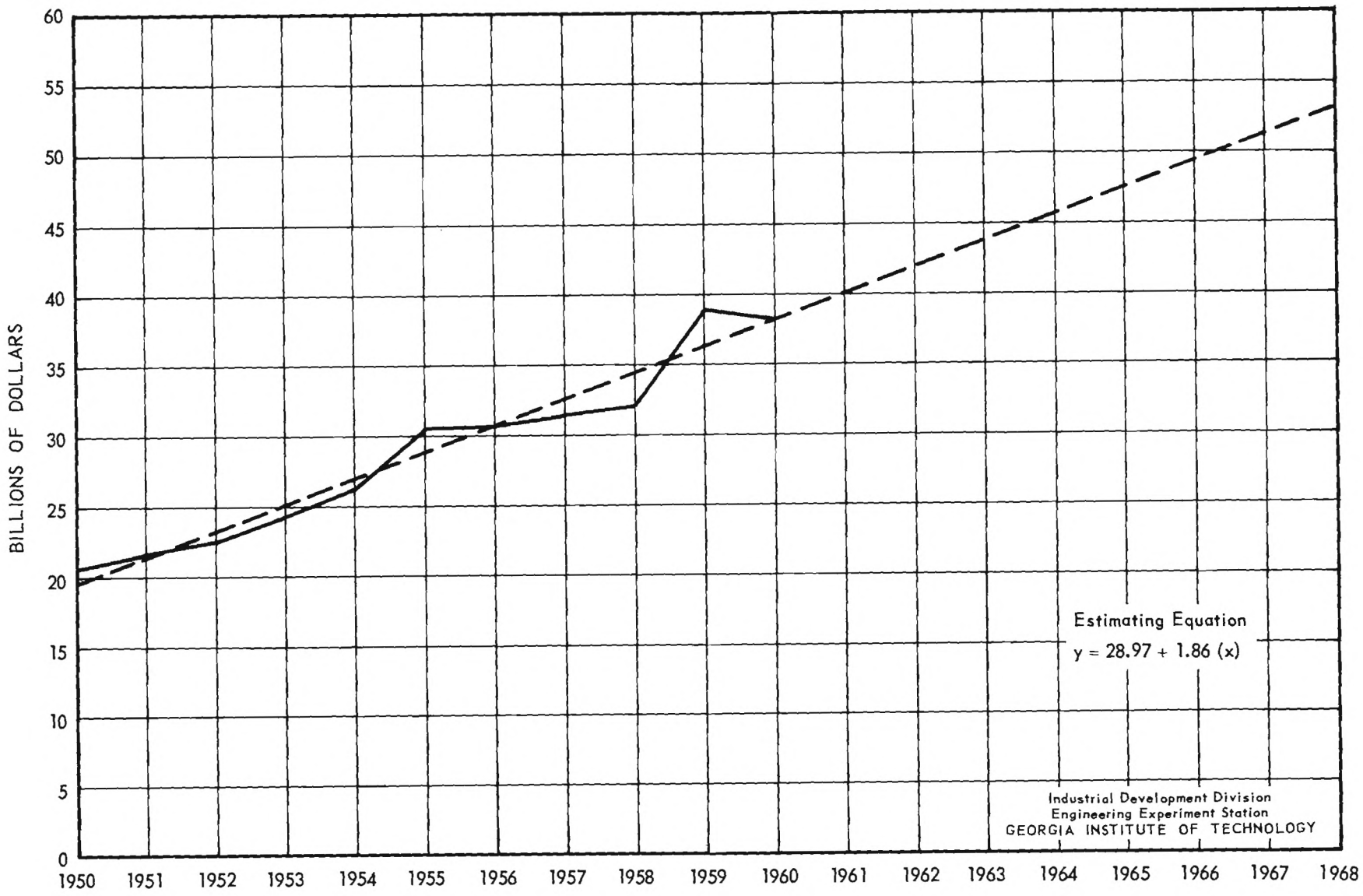
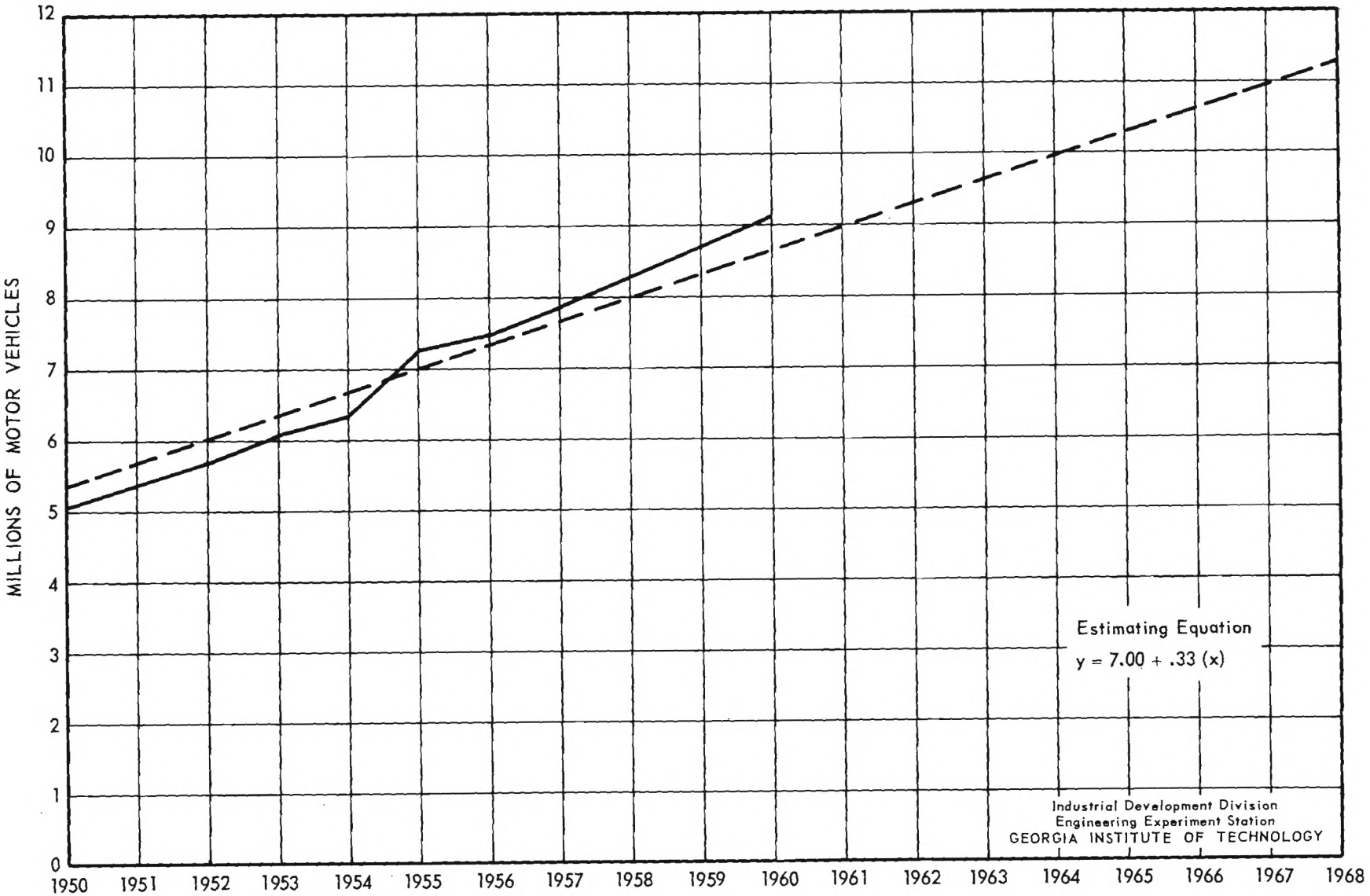


FIGURE 4

TREND IN MOTOR VEHICLE REGISTRATIONS IN THE SOUTHEAST



FLAT GLASS PRODUCTION IN THE SOUTHEAST

The only southeastern state producing flat glass is Tennessee. Two plants owned by American St. Gobain are located at Kingsport and Greenland in the northeast portion of the state. The Kingsport plant produces wire and pattern glass, and the Greenland plant, just completed, will produce plate glass. Annual capacity of the plate plant is reported to be 40 million square feet per year.

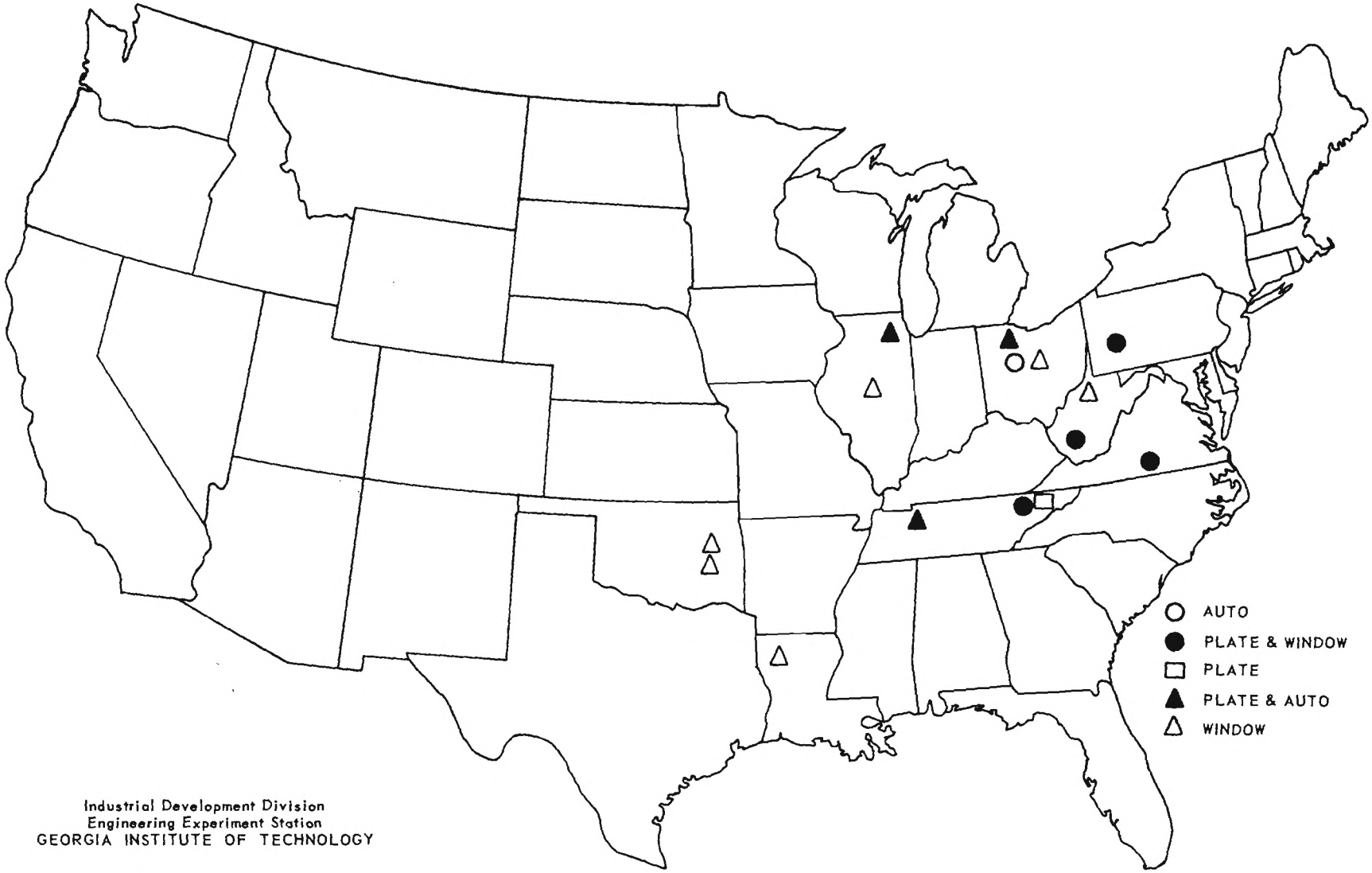
The Ford Glass Division of Ford Motor Company is located at Nashville, Tennessee. This plant, which supplies over 70% of the company's auto glass requirements, is capable of producing over 1,100 tons of glass daily, or about 800,000 square feet. In addition, Ford has a new marketing organization, Motor Craft Corporation, through which it will be marketing its line of auto replacement glass called "car-lite." The company has also begun to produce plate glass for store fronts, but the major emphasis will continue to be on auto glass.

Ford now has two plate and two sheet-making furnaces in operation. The sheet operation, used principally in the manufacture of automotive glass (except windshields), provides the only sheet glass production in the Southeast.

Much of the sheet, plate and automobile glass used in the Southeast comes from plants in Ohio, Illinois and West Virginia. Map 1 shows the location of plants supplying flat glass to the southeastern area.

MAP 1

LOCATION OF FLAT GLASS PLANTS SERVING SOUTHEASTERN MARKETS



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ADVANTAGES OF A GEORGIA LOCATION

A manufacturer of flat glass locating in Columbus, Georgia, would enjoy freight advantages over other plants now serving the Southeast. A plate glass manufacturer, for example, could ship from Columbus to markets in three leading southeastern cities at an average of $3.07 to $20.78 per ton less than present suppliers to these cities. The average freight saving per ton for a Columbus plant shipping plate glass to Atlanta, Birmingham and Miami would be:

Columbus, Ga. over	Rail	Truck
Greenland, Tenn.	$3.93	$3.73
Nashville, Tenn.	3.07	3.79
Clarksburg, W. Va.	12.27	20.78
Ottawa, Ill.	12.00	20.07

Freight costs for window glass would average from $3.90 to $13.21 per ton less from Columbus, Georgia, to the three southeastern cities mentioned above than from Charleston, West Virginia, or Shreveport, Louisiana. With a $5 million sales volume in the Southeast, a Columbus manufacturer would save between $150,000 and $500,000 in freight costs each year. Window glass is also supplied to the Southeast from plants in Clarksburg, West Virginia, and points in Ohio and Illinois which would have even greater freight costs. The differences between freight rates from Columbus and those from Charleston and Shreveport are as follows:

Columbus, Ga. over	Rail	Truck
Charleston, W. Va.	$4.73	$10.21
Shreveport, La.	3.90	13.21

Automobile glass could be supplied from Columbus, Georgia, to the selected southeastern cities at an average of from $4.87 to $19.80 per ton less than from the Nashville plant or from Crestline, Ohio, the next closest auto glass producing area:

Columbus, Ga. over	Rail	Truck
Nashville, Tenn.	$4.87	$5.07
Crestline, Ohio	16.53	19.80

Rail and truck freight costs for all cities and types of flat glass mentioned are listed in Appendix 3.

A Georgia flat glass plant could readily obtain needed raw materials. High purity silica sand (.025% Fe_2O_3) is available from Thomasville, Georgia, 150 miles away. Limestone could be supplied from Anderson, Tennessee, while feldspar may be found at Monticello, Georgia, approximately 100 miles from Columbus. (See Map 2.) Soda ash could be barged up the Chattahoochee River from plants in the Gulf area.

MAP 2

SOURCES OF RAW MATERIALS FOR FLAT GLASS MANUFACTURE

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CONCLUSION

The market for flat glass in the Southeast is large enough to justify the location of either a sheet or plate glass manufacturing plant in the area. The demand for automotive glass in the six-state area would not justify a plant solely for this purpose. However, as a result of the trend toward increased usage of sheet glass in all areas of the automobile except the windshield, a sheet glass manufacturer could economically direct his production toward both the automotive and window glass market.

A sheet glass manufacturer serving the Southeast from Columbus, Georgia, would enjoy the following benefits:

1. a high volume market in the southeastern construction industry,
2. freight advantages over plants now supplying the area, and
3. an expanding market for high quality sheet (vertically drawn and tempered) in the automotive field.

The freight savings for a Columbus, Georgia, manufacturer with an annual output of $5 million would be between $150,000 and $500,000. This is equal to an increased profit on sales of 3% to 10%.

Appendix 1

CORRELATION BETWEEN FLAT GLASS PRODUCTION AND RESIDENTIAL AND NONRESIDENTIAL CONSTRUCTION

Year	X	Y	$\frac{x}{(x-A)}$	$\frac{y}{(y-A)}$	xy	x^2	y^2
1950	2351	2061	-733	-836	612788	537289	698896
1951	2488	2177	-596	-720	429120	355216	518400
1952	2315	2265	-769	-632	486008	591361	399424
1953	2682	2436	-402	-461	185322	161604	212521
1954	2630	2660	-454	-237	107598	206116	56169
1955	3364	3080	280	183	51240	78400	33489
1956	3338	3081	254	184	46736	64516	33856
1957	3600	3159	516	262	135192	266256	68644
1958	2932	3221	-152	324	-49248	23105	104976
1959	4133	3900	1049	1003	1052147	1100401	1006009
1960	4095	3822	1011	925	935175	1022121	855625
Total	33928	31862			3992078	4406385	3988009
A (Average	3084	2897)					

$$G_x = \sqrt{\frac{Sx^2}{N}} = \sqrt{\frac{4406385}{11}} = \sqrt{400580} = 633$$

$$G_y = \sqrt{\frac{Sy^2}{N}} = \sqrt{\frac{3988009}{11}} = \sqrt{362546} = 602$$

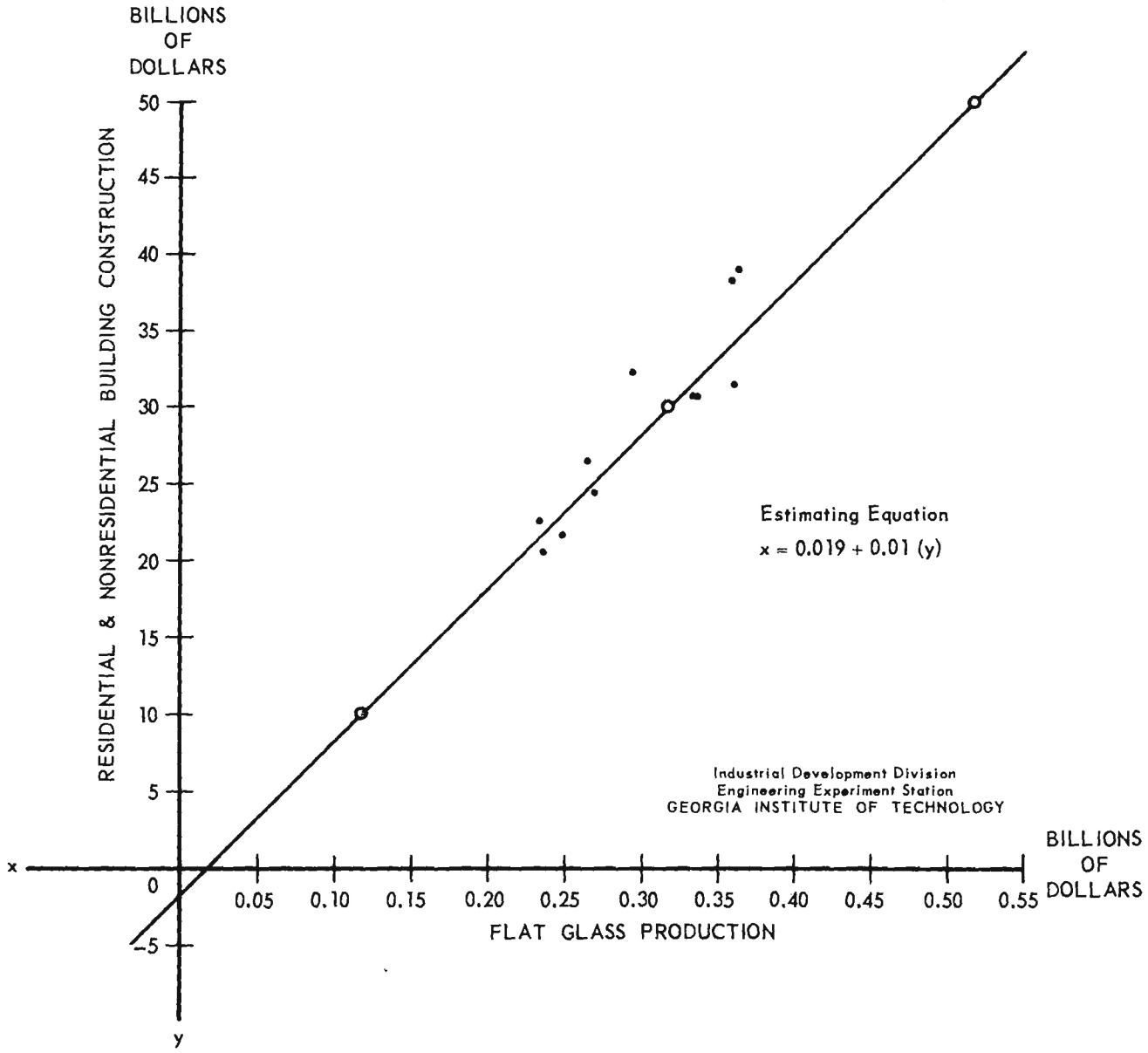
$$\text{Coefficient: } r = \frac{Sxy}{NG_xG_y} = \frac{3992078}{11(633)(602)} = \frac{3992078}{4191726} = .952$$

X = Flat Glass Production

Y = Residential and Nonresidential Construction

APPENDIX 2

SCATTER DIAGRAM FOR FLAT GLASS PRODUCTION AND RESIDENTIAL AND NONRESIDENTIAL BUILDING CONSTRUCTION BY DOLLAR VOLUME



Appendix 3

RAIL AND TRUCK FREIGHT COSTS FROM COLUMBUS AND MAJOR GLASS PRODUCING AREAS TO SELECTED SOUTHEASTERN CITIES

Plate Glass

Rail Freight Costs Per Carload (70,000 lbs.) to Selected Southeastern Cities

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$514.00	$417.00	$819.00	$583.33
Greenland, Tenn.	553.00	609.00	1,001.00	721.00
Nashville, Tenn.	553.00	476.00	1,043.00	690.67
Clarksburg, W. Va.	882.00	896.00	1,260.00	1,012.67
Ottawa, Ill.	882.00	819.00	1,309.00	1,003.33

Sheet (Window) Glass

Rail Freight Costs Per Carload (70,000 lbs.) to Selected Southeastern Cities

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$297.50	$325.50	$644.00	$422.33
Charleston, W. Va.	476.00	518.00	770.00	588.00
Shreveport, La.	518.00	395.50	763.00	558.83

Automobile Glass

Rail Freight Costs Per Carload (30,000 lbs.) to Selected Southeastern Cities

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$176.00	$196.00	$383.00	$251.67
Nashville, Tenn.	261.00	222.00	491.00	324.67
Crestline, Ohio	425.00	425.00	649.00	499.67

Plate Glass

Truckload Freight Costs to Selected Southeastern Cities
(minimum weight 22,000 lbs.)

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$123.20	$151.80	$299.20	$191.40
Greenland, Tenn.	145.20	191.40	360.80	232.47
Nashville, Tenn.	202.20	114.40	382.80	233.13
Clarksburg, W. Va.	349.80	356.40	556.60	420.93
Ottawa, Ill.	327.80	325.60	583.00	412.13

Although the minimum weights may vary for the above cities, for comparison purposes these costs are all based on 22,000 pounds minimum weight.

Sheet (Window) Glass

Truckload Freight Costs to Selected Southeastern Cities
(minimum weight 22,000 lbs.)

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$109.80	$134.20	$261.80	$168.60
Charleston, W. Va.	217.80	250.80	374.00	280.87
Shreveport, La.	255.20	209.00	477.40	313.87

Although the minimum weights may vary for the above cities, for comparison purposes these costs are all based on 22,000 pounds minimum weight.

Automobile Glass

Truckload Freight Costs to Selected Southeastern Cities
(minimum weight 22,000 lbs.)

From	To			
	Atlanta	Birmingham	Miami	Three City Average
Columbus, Ga.	$123.20	$151.80	$299.20	$191.40
Nashville, Tenn.	187.00	171.60	382.80	247.13
Crestline, Ohio	332.20	332.20	563.20	409.20

Although the minimum weights may vary for the above cities, for comparison purposes these costs are all based on 22,000 pounds minimum weight.